SESSION II: WHEAT QUALITY

Association analysis of hard white wheat high- and low-molecular-weight glutenin subunits and their relationship to end-use functionality.

Sarah Harmer, Bradford Seabourn, Paul St. Amand, and Guihua Bai. USDA–ARS, Center for Grain & Animal Health Research (CGAHR), 1515 College Ave, Manhattan, KS 66502, USA.

Allelic variation at the glutenin loci is known to contribute to end-use qualities in wheat (*Triticum aestivum* L.). The *Glu-A1*, *Glu-B1*, and *Glu-D1* loci, which encode high-molecular-weight glutenin subunits (HMW-GS), and the *Glu-A3*, *Glu-B3*, and *Glu-D3* loci, which encode low-molecular-weight glutenin subunits (LMW-GS), are highly polymorphic and many combinations of alleles exist in different breeding programs. However, the effect of different glutenin alleles at all six loci on dough and bread-making properties is poorly characterized, particularly in U.S. breeding programs. In this study, a set of advanced breeding lines and cultivars from the USDA–ARS Hard Winter Wheat Regional Performance Nursery (RPN) was used to determine the effects of glutenin alleles and 1RS translocation on mixograph peak time (MPT) (adjusted for protein content) and loaf volume (LV). Association analysis was implemented using the MIXED model procedure to reduce spurious associations. The ANOVA results demonstrate that both *Glu-B1* and *Glu-D1* loci had a significant effect ($P < 0.0005$) on MPT, with *Glu-B1al*, *Glu-D1d*, and *Glu-B1f* alleles associated with longer MPT, whereas the *Glu-B1e* and *Glu-D1a* alleles were associated with reduced MPT. The *Glu-D3* locus had a significant influence ($P < 0.05$) on LV, with the *Glu-D3f* allele generally associated with increased LV compared to other alleles at that locus. Although the presence of the 1RS translocation did not have a significant effect on MPT, it was significantly correlated with LV ($P < 0.005$), with the T1BL·1RS translocation associated with decreased LV.

A new viscoelastic test for assessing wheat gluten strength.

Steven Mulvaney [1], Patricia Rayas-Duarte [2], Bo Allvin [3], Stephen Delwiche [4], Bradford Seabourn [4], Patrick McCluskey [5], and **Rangan Chinnaswamy** [5].

[1] Department of Food Science, Cornell University, Ithaca, NY 14853, USA; [2] Department of Biochemistry and Molecular Biology, Oklahoma State University, Stillwater, OK 74078, USA; [3] Perten Instruments AB, Källängsvägen 2, SE-141 71 Segeltorp, Sweden; [4] USDA–ARS, Center for Grain & Animal Health Research (CGAHR), 1515 College Ave, Manhattan, KS 66502 USA; and [5] Grain Inspection, Packers and Stockyards Administration (GIPSA)–USDA, Washington, DC 20250-3601, USA.

Buyers of U.S. wheat have long been asking for functional quality information. Through a meeting with a broad group of wheat researchers, GIPSA has identified gluten strength as a key intrinsic property that may provide this information. A shipload is made up of different wheat cultivars grown in diverse regions; therefore, it is likely that there will be varied functional characteristics within and between shipments. As the industrial processing capabilities of wheat buyers become more automated, varied consistency within and between shipments presents serious challenges. Since the 1930s, over one dozen dough functional test methods came into being, and generally, they are burdensome and empirical in nature. All of these methods, in one way or another, assess dough or gluten rheological characteristics; however, few if any of them are rapid enough for use in the field to test and blend wheat to meet buyers' needs. On the other hand, provided with a rapid test, the sophisticated grain handling systems in the U.S. are fully capable of tailor-making wheat lots to meet the needs of processors. Therefore, GIPSA is engaged in the development of a scientifically sound, rapid test for assessing wheat functionality. This test could be used to assess gluten strength from the breeder to the processor, eventually leading to a standardized method that could be used throughout the wheat marketing chain. With this goal in mind, a workgroup has been formed to test new concepts and develop a fundamentally sound, yet rapid, viscoelastic test for assessing gluten strength. The results of exploratory work using novel instrument prototypes, which have shown promise, will be presented.